Urban Density

SOLEC Indicator #7000

Purpose

This indicator measures human population density and indirectly measures the degree of inefficient land use and urban sprawl for communities in the Great Lakes Basin. The number of people that inhabit a community relative to its size is an indicator of the economic efficiency of that community based on the existence of 'economies of scale' associated with high density development.

Ecosystem Objective

Increasing urban density promotes economic viability and the pursuit of sustainable development, which are generally accepted goals for society. These objectives are threatened when population growth is concentrated such that urban development does not occur at the expense of wetland and other natural resources, through expansions of urban sprawl. High density growth is an alternative to urban sprawl.

State of the Ecosystem

There are marked differences around the Great Lakes Basin is communities' urban densities. Initial research results indicates that there appears to be differences between Canadian and US communities, although other factors, such as ongoing 'rust belt' US population declines, may be partly responsible for the statistical differences in urban densities.

Figure 1 below illustrates the urban densities among the larger more established urban cities of Toronto, Ontario and Cuyahoga County, Ohio (which includes Cleveland) and the two smaller communities of the Regional Municipality of Niagara, Ontario and Niagara County, New York.

In addition, there are significant differences in the sizes of these municipalities. The two Toronto and the Regional Municipality of Niagara in Ontario are, respectively, twice the size in population than Cuyahoga County, Ohio and Niagara County, New York. Further, Toronto is part of a larger urban developed area, known as the Greater Toronto Area which in total has an urban density that is closer to Cuyahoga County.

The Canadian Province of Ontario, unlike most Great Lakes US states, has influenced urban growth with a highly centralized planning system, which employs clear provincial planning policies, guidelines and performance indicators. However, those policies have shifted over the last decade towards encouraging greater suburban expansion through urban sprawl, including provisions for expansion into 'prime' agricultural lands.

Trends over the last ten years indicate that population densities are increasing in both of the Canadian communities sampled and stable to declining in the US communities. Increased new suburban low-density development in the US communities, simultaneous with declining populations is exacerbating the fall in densities. While the Canadian communities are experiencing increasing densities, there is on-going low-density suburban pressure, particularly for the Greater Toronto Area.

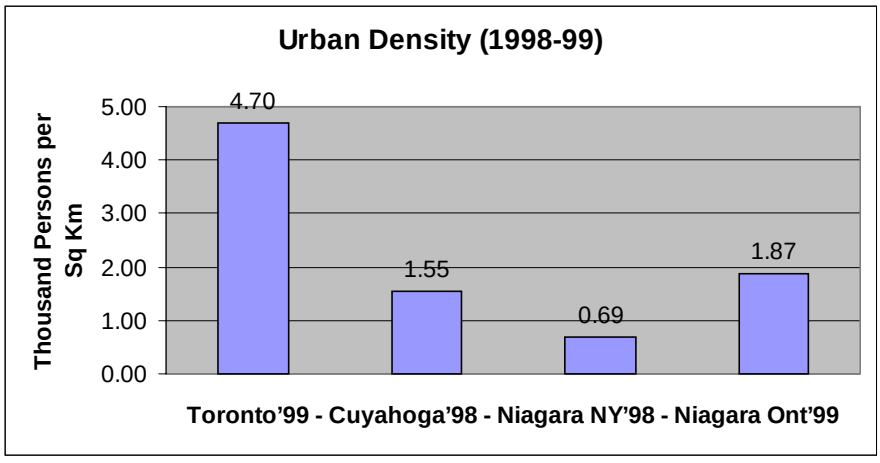

Figure 1. Urban densities in four Great Lakes urban communities.

There are corresponding significant relationships between urban density and other indicators of land use, such as urban transit. This indicates that urban efficiency and the development of sustainable communities may be causally linked to the degree of urban population concentration.

Future Pressures on the Ecosystem

Apparent trends toward increasing urban densities in Ontario, notwithstanding, urban sprawl continues to place pressure on economic as well as environmental resources in Great Lakes basin communi-

ties. Continued low density development throughout the basin may have significant irreversible negative implications for the Great Lakes ecosystem.

Future Action

There exists, in most Great Lakes communities, the potential for increased use of brownfields and other underutilized areas within the existing developed sections of urban communities. Road, water and sewer and other infrastructure, typically is already in place to make this (re-) development economically viable and to conserve resources from being expended to clear land and install new infrastructure. Urban concentration policies at all levels of government that promote increased urban density are essential for this to happen.

Further Work Necessary

Additional research is required to survey other communities around the Great Lakes basin to determine the extent of current knowledge on community urban densities. Also, there is a need to further understand the broader economic and environmental significance of different urban densities around the basin and the fuller implications of declining and increasing densities. There is also a need to set standards for collecting and reporting on land use data, including urban density. Finally, governments at all levels should join public interest groups and academic institutions in this research to broaden its appeal and understanding.

Sources

Rivers Consulting and J. Barr Consulting. "State of the Lakes Ecosystem Conference – Land Use Indicators Project". Unpublished report Environment Canada. July 30, 2000.

Acknowledgments

Authors: Ray River, Rivers Consulting, Campbellville, ON, and John Barr, Burlington, ON.

Brownfields Redevelopment

SOLEC Indicator #7006

Purpose

To assess the acreage of redeveloped brownfields, and to evaluate over time the rate at which society rehabilitates and reuses former developed sites that have been degraded or abandoned.

Ecosystem Objective

The goal of brownfields redevelopment is to remove threats of contamination associated with these properties and bring them back into productive use. Remediation and redevelopment of brownfields results in two types of ecosystem improvements: 1) reduction or elimination of environmental risks from contamination associated with these properties; and 2) reduction in pressure for open space conversion as previously developed properties are reused.

State of the Ecosystem

All eight Great Lakes states, Ontario and Quebec have programs to promote remediation or "cleanup" and redevelopment of brownfields sites. Several of the brownfields cleanup programs have been in place since the mid to late 1980s, but establishment of more comprehensive brownfields programs that focus on remediation and redevelopment has occurred during the 1990s. Today, each of the Great Lake states has a voluntary cleanup or environmental response program that offers a range of risk-based, site specific background and health cleanup standards that are applied based on the specifics of the contaminated property.

Efforts to track brownfields redevelopment are uneven among Great Lakes jurisdictions. Not all jurisdictions track brownfields activities and methods vary where tracking does take place. More fundamentally, there is no single definition for brownfields. Most states track the number sites remediated through the state brownfields or cleanup program and some also track the number sites that have been redeveloped. However, the size of brownfields varies greatly so the number of sites is not an effective indicator for assessing land renewal efforts. The overall number of sites being addressed does say something about the level of cleanup activity, but this becomes problematic when there are several different programs that address brownfields, but not brownfields alone. Where cleanups do not have formal reporting requirements, so there is no information base for tracking brownfield cleanups or redevelopment. No Great Lakes state or province tracks acres of brownfields *redeveloped*, though several are beginning to track acres of brownfields *remediated*.

Remediation is a necessary precursor to redevelopment. Remediation is often used interchangeably with "clean-up," though brownfields remediation does not always involve removing all contaminants from the sites. Remediation includes, *removal*, *treatment* and *exposure controls*. In many cases, the cost of truly cleaning up (i.e., treating) or removing the contaminants would prohibit redevelopment or reuse. To address this obstacle to brownfields reuse, all Great Lakes states and provinces allow some contaminants to remain on site as long as the risks of being exposed to those contaminants are eliminated or reduced to acceptable levels. Capping a site with clean soil, or restricting the use of groundwater are examples of these "exposure controls" and their use has been a major factor in advancing brownfields redevelopment.

Information on acres of brownfields remediated from Illinois, Minnesota, New York, and Pennsylvania indicates that a total of 28,789 acres of brownfields have been remediated in these jurisdictions alone. Available data from six Great Lakes states indicates that more than 8,662 brownfield sites have participated in brownfields cleanup programs. Redevelopment is a criteria for eligibility under many state brownfields cleanup programs. Where local brownfields cleaned up and redevelopment efforts are independent of state/provincial funding or oversight, redevelopment activities may go underreported at the state/provincial level. Though there is inconsistent and inadequate data on acres of brownfields remediated and/or redeveloped, available data indicate that both brownfields cleanup and redevelopment efforts have risen dramatically since the mid 1990's with the new wave of risk-based cleanup standards and widespread use of state liability relief mechanisms that allow private parties to redevelop, buy or sell property without being held liable for contamination they did not cause. Data also indicates that the majority of cleanups in Great Lakes states and provinces are occurring in older urbanized areas, many of which are

located on the Great Lakes and in the basin. Based on this information, the state of brownfields redevelopment is good and improving.

Future Pressures
Some debate has occurred regarding the long-term effectiveness of exposure controls. One could conclude that as long as the controls are monitored and enforced, there will be no unacceptable risks to human health or the environment from their use. However, there are no Great Lakes state or federal programs in place to ensure long-term monitoring and enforcement of exposure controls. Also, cleanup standards based on risks to human health may not be appropriate for brownfields cleanup that results in habitat creation/ enhancement.

Several Great Lakes states allow brownfields redevelopment to proceed without cleaning up contaminated groundwater as long as no one is going to use or come into contact with that water. However, where migrating groundwater plumes ultimately interface with surface waters, some surface water quality may continue to be at risk from brownfields contamination even where brownfields have been pronounced "clean."

Land use and economic policies that encourage new development to occur outside already developed areas over urban brownfields is an ongoing pressure that can be expected to continue.

Future Activities
Exposure controls need to be monitored and enforced over the medium and long-term. Federal and state agencies need to agree as to which level of government is best-suited for this task. More research may be needed to determine the relationship between groundwater supplies and Great Lakes surface waters and their tributaries. Because brownfields redevelopment results in both elimination of environmental risks from past contamination and reduction in pressure for open space conversion, data should be collected that will enable an evaluation of each of these activities.

Future Work Necessary
Great Lakes states and provinces have begun to track brownfields remediation and/or redevelopment, but the data is generally not available or searchable in ways that are helpful to assess progress toward meeting the terms of the Great Lakes Water Quality Agreement.

Consistency in data gathering also presents challenges for assessing progress in the basin overall. States and provinces should share ideas and work with local jurisdictions to develop consistent tracking mechanisms and build shared online data bases on brownfields redevelopment that can be searched by: 1) environmental remediation (acres remediated or mass (i.e., pounds) of contamination remediated); 2) mass of contamination removed or treated (i.e., not requiring an exposure control); 3) geographic location; 4) level of urbanization; and 5) type of reuse (i.e., commercial, residential, open space, none, etc).

Sources
Personal communication: Great Lakes State Brownfield/Voluntary Cleanup Program Managers; Publications: *Evaluation of Effectiveness: Pennsylvania Land Recycling and Environmental Remediation Standards Act*, January, 2000; Indiana Voluntary Remediation Program Statistics Web Page; *Illinois, Site Remediation Program 1999 Annual Report*; *Wisconsin Remediation and Redevelopment Biennial Reports, 1997 and 1999*; Wisconsin Bureau of Remediation and Redevelopment Tracking System (online).

Acknowledgments
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Mass Transportation

SOLEC Indicator #7012

Purpose

This indicator directly measures the percentage of daily commuters that use public transportation or other alternatives to the private car and indirectly measures the stress to the Great Lakes ecosystem caused by the use of the private motor vehicle and its resulting high resource utilization and creation of pollution.

Ecosystem Objective

Current use of the private automobile for commuting in the largely low density urban sprawl communities of the Great Lakes basin is very inefficient. Reliance on the private automobile has encouraged the development of expansive roadways and parking areas to accommodate the automobile. Extensive use of the automobile has led to significant ecosystem problems including air pollution, high personal and public costs associated with the automobile, and loss of leisure, work or other time due to traffic congestion. The ecosystem objective involves responding to Annex 1, 3 and 15 of the Great Lakes Water Quality Agreement.

State of the Ecosystem

There are marked differences among the Great Lakes Basin communities' in automobile usage for commuting. Initial research results indicates that there also appear to be differences between Canadian and US communities. Figure 1 below illustrates the percentage of daily commuters (for all purposes over 24 hours a day) that use alternatives to the private automobile to commute to work, play, etc. in four communities surveyed in the basin. Among the larger more established urban cities of Toronto, Ontario and Cuyahoga County, Ohio (which includes Cleveland) alternatives are higher than in the more lightly populated and smaller communities of the Regional Municipality of Niagara, Ontario and Niagara County, New York.

There is a direct relationship between public transportation and the degree of urban density. The community with the highest concentration of population also had the highest rate of non-auto commuting and public transit usage. This relationship was pronounced in Toronto where higher density also facilitated greater use of bicycling and walking among urban commuters.

However, the biggest differences are with public transportation. Figure 2 illustrates how the densely populated community of Toronto has by far the greatest urban commuting rates In addition, there are significant differences in the sizes of these municipalities.

Trends for non-automobile urban commuting in Toronto have been relatively static over the last decade.

Future Pressures on the Ecosystem

Population has been increasing on the Canadian portion of the Great Lakes basin, although urban transportation has been relatively constant over the last decade. The result has been increasing traffic gridlock and increasing air pollution. Recent development pressure has been towards low density urban sprawl making public transportation use more difficult, since low density development in not conducive to mass transportation.

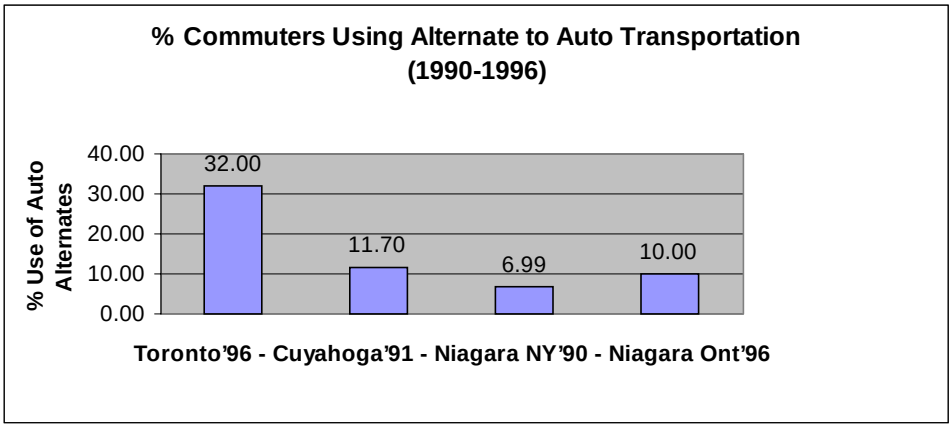

Figure 1. Percentage of Commuters using Alternatives to Automobiles in Selected Communities

Future Action

There exists, in most Great Lakes communities, the potential for increased use of public transportation and other means of non-auto commuting. Development of the urban form, urban density and an effective and cost-effective public transportation infrastructure are the keys to improving transit rates throughout the basin.

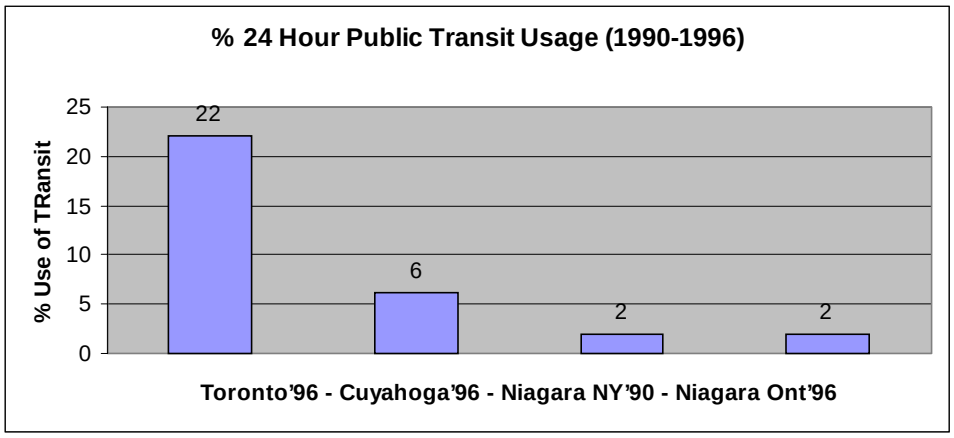

Figure 2. Percentage of Commuters Using Public Transit

Further Work Necessary

Additional research is required to survey other communities around the Great Lakes basin to better understand the relationship between rates of non-auto commuting and urban density, the effectiveness and cost effectiveness of public transportation, and the impact of alternate types of urban form. There is also a need to set standards for collecting and reporting on land use data, including urban density. Finally, governments at all levels should join public interest groups and academic institutions in this research to broaden its appeal and understanding.

Sources

Rivers Consulting and J. Barr Consulting. "State of the Lakes Ecosystem Conference – Land Use Indicators Project". Unpublished report Environment Canada. July 30, 2000.

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Authors: Ray Rivers, Rivers Consulting, Campbellville, ON, and John Barr, Burlington, ON.

Sustainable Agricultural Practices

SOLEC Indicator #7028

Purpose

To assess the number of Environmental and Conservation farm plans and environmentally friendly practices in place; such as integrated pest management to reduce the potential adverse impacts of pesticides, conservation tillage and other soil preservation practices to reduce energy consumption, prevent ground and surface water contamination, and achieve sustainable natural resources.

Ecosystem Objective

This indicator supports Annex 2, 3, 12 and 13 of the GLWQA. The objective is the sound use and management of soil, water, air, plant, and animal resources to prevent degradation. The process integrates natural resource, economic, and social considerations to meet private and public needs. The goals are to create a healthy and productive land base that sustains food and fiber, functioning watersheds and natural systems, enhances the environment and improves the rural landscape.

State of the Ecosystem

Agriculture accounts for 35 present of the land area of the Great Lakes basin and dominates the southern portion of the basin. In the past excessive tillage and intensive crop rotations led to soil erosion and resulting sedimentation of major tributaries. Inadequate land management practices contributed to 63 million tons of soil eroded annually by the 1980's. Ontario estimated it's costs of soil erosion and nutrient/ pesticide losses at $68 million annually. Agriculture is a major user of pesticides with an annual use of 26,000 tons. These practices led to a decline of soil organic matter. Recently there has been increasing cooperation with the farm community on Great Lakes water quality management programs. Today's conservation systems have reduced the rates of U.S. soil erosion by 38 percent in the last few decades. The adoption of more environmentally responsible practices has helped to replenish carbon in the soils back to 60 percent of turn-of-the century levels.

Both the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the USDA's Natural Resources Conservation Service (NRCS) provide conservation planning advice, technical assistance and incentives to farm clients and rural landowners. Clients develop and implement conservation plans to protect, conserve, and enhance natural resources that harmonize productivity, business objectives and the environment. Successful implementation of conservation planning depends upon the voluntary participation of clients.

The Ontario Environmental Farm Plan (EFP) encourages farmers to develop action plans and adopt environmentally responsible technologies through the Ontario Farm Environmental Coalition (OFEC) workshops delivered in partnership with OMAFRA. Recently, with the technical assistance of OMAFRA, OFEC released a Nutrient Management Planning Strategy and accompanying software to enable farmers to develop individualized nutrient management plans.

USDA's voluntary Environmental Quality Incentives Program provides technical, educational, and financial assistance to landowners that install conservation systems. The Conservation Reserve Program allows landowners to converts environmentally sensitive acreage to vegetative cover. States may add funds to target critical areas under the Conservation Reserve Enhancement Program and the Wetlands Reserve Program is a voluntary program to restore wetlands.

Future Pressures

The trend towards increasing farm size and concentration of livestock will change the face of agriculture in the basin. Development pressure from the urban areas may increase the conflict between rural and urban landowners. This can include higher taxes, traffic congestion, flooding and pollution. By urbanizing farmland we may limit future options to deal with social, economic, food security and environmental problems.

Future Actions

Ontario is developing a Best Management Practices (BMP) book on Riparian Buffers, and a Livestock Operations Standards Act. Food Systems 2000, started in 1987, set a target of reducing agricultural pesticides by 50 percent while maintaining effective pest control, and competitive, sustainable farms. Partnerships between agriculture and municipalities include incentives for BMP's to reduce phosphorus loading and protect rural water quality.

The US Clean Water Action Plan of 1998 calls for USDA and the Environmental Protection Agency to cooperate further on soil erosion control, wetland restoration, and reduction of pollution from farm animal operations. National goals are to install 2 million miles of buffers along riparian corridors by 2002 and increase wetlands by 100,000 acres annually by 2005. Under the 1999 EPA/ USDA Unified National Strategy for Animal Feeding Operation (AFO) all AFO's will have nutrient management plans implemented by 2009.

Sources

This indicator was prepared using information from:

Great Lakes Commission. 1996. An Agricultural Profile of the Great Lakes Basin.

International Joint Commission. 1998. Ninth Biennial Report on the Great Lakes.

Natural Resources Conservation Service. 1999. NRCS Performance and Results Measurement System.

Acknowledgments

Authors: Roger Nanney, US Natural Resources Conservation Service, Chicago, IL, and Peter Roberts, Ontario Ministry of Agriculture, Food and Rural Affairs, Guelph, ON.

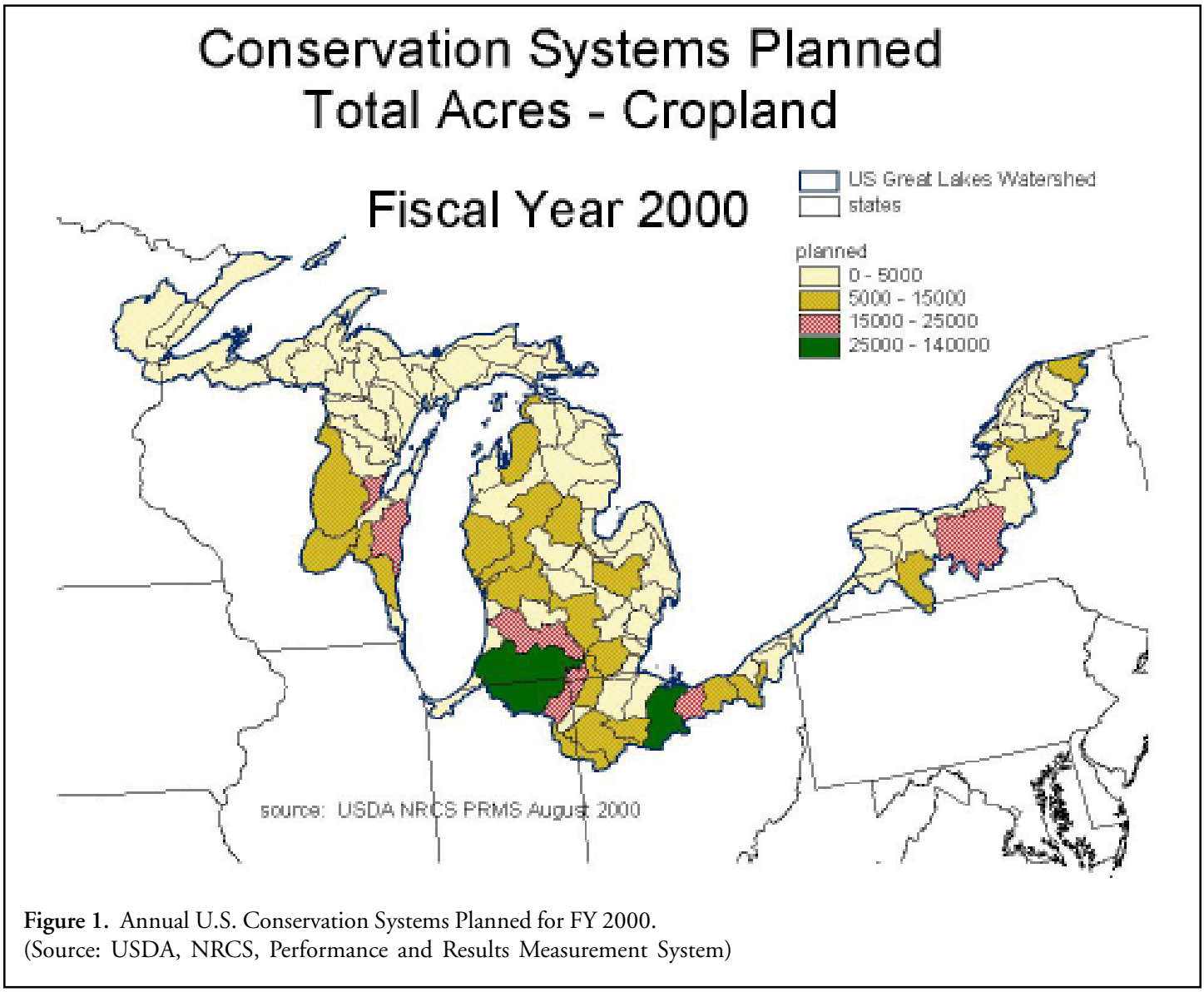
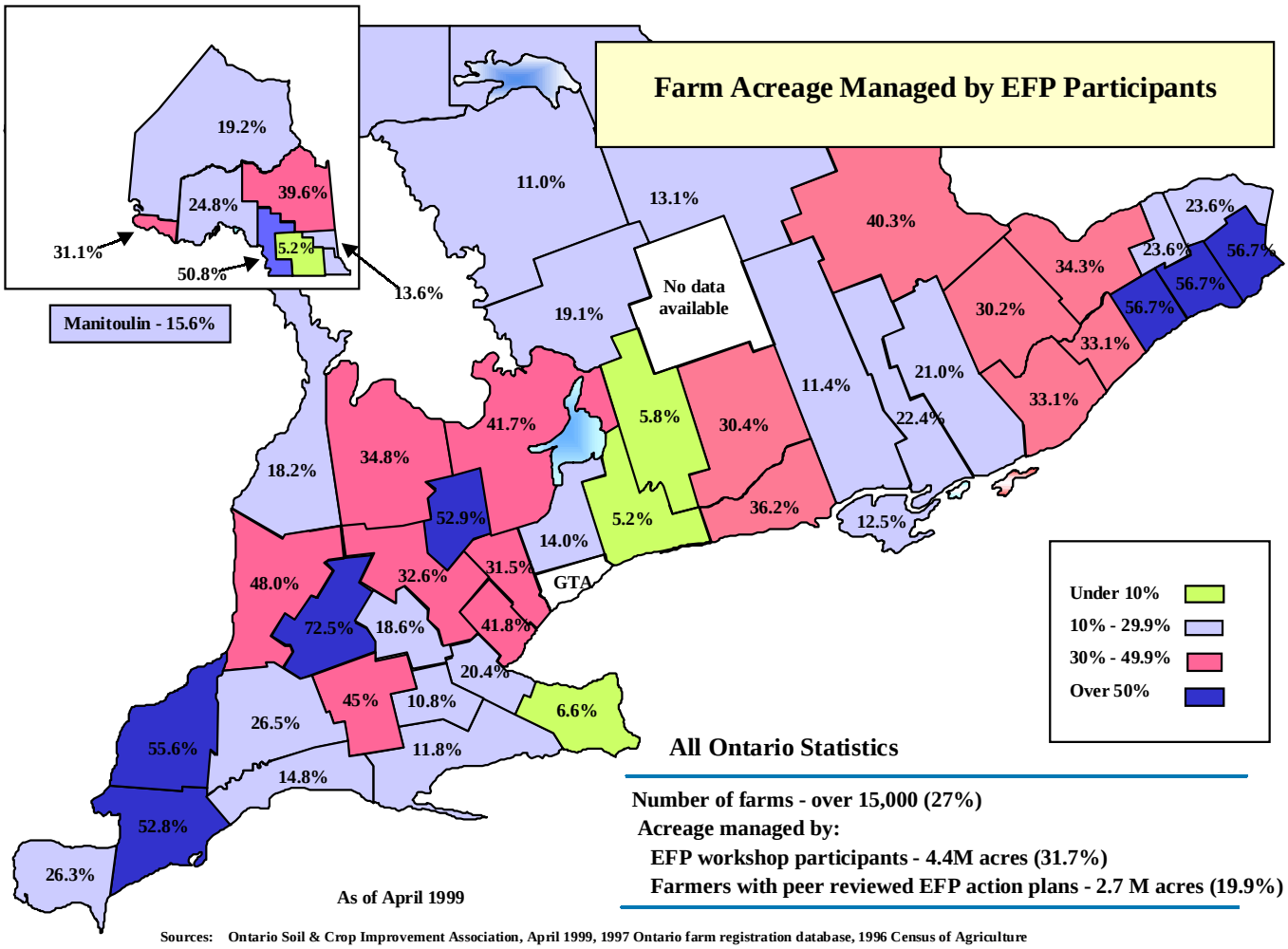


Figure 1. Annual U.S. Conservation Systems Planned for FY 2000.
(Source: USDA, NRCS, Performance and Results Measurement System)



Sources: Ontario Soil & Crop Improvement Association, April 1999, 1997 Ontario farm registration database, 1996 Census of Agriculture

Figure 2.